Series 430

Pneumatic Indicating Controllers Type 3430



Type 3432 Controller Station
– with Type 3435 Transmitter Module for Pressure
– with Type 3436 Transmitter Module for Temperature
– with Type 3438 Transmitter Module for Temperature (Pt 100)
– for standardized signals
Version shown with lockable door and integrated Type 3436 Transmitter Module for Temperature

Type 3431 Controller Station
– for standardized signals

Fig. 1 · Controller stations

Mounting and Operating Instructions

EB 7030 EN

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General safety instructions

- *The device may only be assembled, started up or operated by trained and experienced personnel familiar with the product.*
  According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.
- *Explosion-protected versions may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas.*
- *Any hazards that could be caused by the signal pressure are to be prevented by means of the appropriate measures.*
- *Proper shipping and appropriate storage of the device are assumed.*

1 Application

The Series 430 Pneumatic Indicating Controllers are used for applications in process automation and industrial plants.
The controllers directly measure the controlled variables (pressure, temperature, electric or pneumatic standardized signal) and display the value. They compare the measured variable with the set point and issue a corresponding pneumatic control signal from 0.2 to 1 bar (3 to 15 psi).

A supply pressure of 1.4 bar ± 0.1 bar (20 psi ± 1.5 psi) is required or an operating pressure of 2 to 12 bar (30 to 180 psi) when a supply pressure regulator is installed.

2 Operation

2.1 Settings at the controller modules

The controller module in the station can be accessed after the lock (Fig. 2) has been released and the indicating unit (5) has been opened out.
The settings for operating action (turnboard **A**) and air supply (turnboard **B**) must be performed prior to commissioning.

- Unscrew the mounting screw (6) on the controller module. Pull it off its self-sealing hose fittings and lift out of the controller station.

2.1.1 Operating action

The operating action for the control loop is set at the turnboard **A** (Fig. 2), where the position of its arrow symbol according to the arrow symbol on the controller module determines the operation action of the controller.

◀ ▶ Arrow tips facing opposite directions:
Operating direction:
Increasing/decreasing =
As the controlled variable x increases, the output signal pressure y decreases.

▶ ▶ Arrow tips facing the same direction:
Operating direction:
Increasing/increasing
As the controlled variable x increases, the output signal pressure y increases.

Setting or modifying the operating direction:

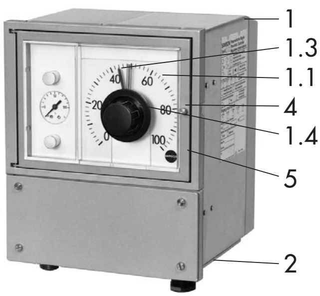
Unfasten the screw in turnboard **A** (Fig. 2) and lift it off together with the turnboard. If necessary, lever the board at the side.
Do not lose the rubber seal.

- Turn the board by 90° so that the required arrow is aligned with the arrow on the base plate.
- Insert board and tighten screw.
- Reassemble the controller module in the controller station.

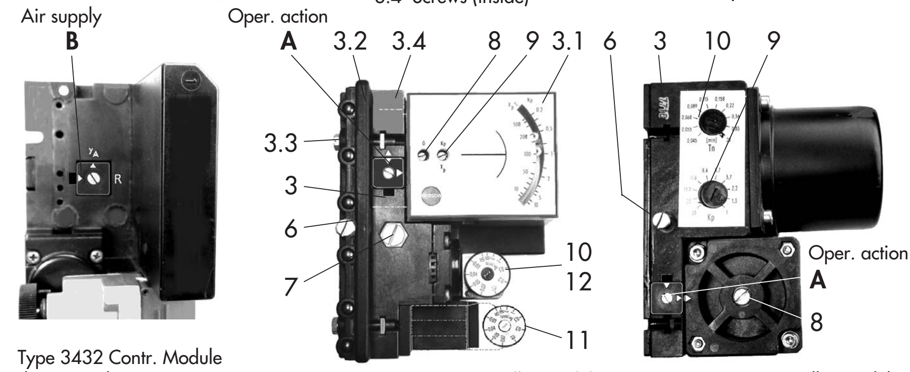
2.1.2 Air supply

(only with Type 3433 Controller Module)
The position of the turnboard **B** (Fig. 2) with its arrow symbol determines the air supply to the feedback bellows. It can be accessed after the comparator (3.1) has been removed.

- **yA** Normal air supply, approx. 1 m_n^3/h per % of the system deviation
- **R** Large air supply, approx. 3 m_n^3/h per % of the system deviation (not with P or PD controller modules)



1 Controller station (Type 3432)
1.1 Scale
1.3 Actual value pointer (red)
1.4 Set point adjuster
2 Transmitter module or connecting base
3 Controller module
3.1 Comparator
3.2 Connecting plate
3.3 Hex screws
3.4 Screws (inside)
4 Lock
5 Indicating unit
6 Mounting screw
7 Restriction
8 Zero adjuster
9 Kp adjuster
10 Tn adjuster
11 Tv adjuster (only in PD or PID controller)
12 Operating point adjuster (only in P or PD controller)



Type 3432 Contr. Module
Side view without comparator

Type 3433-2 (PI) Controller Module

Type 3434-2 (PI) Controller Module

Fig. 2 · Turnboards and adjusters

- Unfasten screws (3.3) and pull off the connecting plate (3.2) together with nuts and bolts from the controller module.
- Unscrew the hexagonal socket-head screws (3.4) at the side and lift the comparator (3.1) out of the controller module.

Setting or modifying the air supply:

- Unfasten screw in turnboard **B** and lift it off together with the turnboard. If necessary, lever the board at the side.
  Do not lose the rubber seal.
- Turn the board so that the arrow is aligned with the mark **yA** or **R** on the controller module. Insert board and tighten screw.
- Reassemble the controller module in the controller station.

2.1.3 Proportional-action coefficient Kp

The setting of the K_P (adjuster 9) determines the controller gain and is related to the controlled system that is being tuned (section 3.1).

2.1.4 Reset time Tn

Controller versions with integral-action component require the reset time to be set at the restriction (10). The setting depends on the controlled system that is being tuned (section 3.1).

2.1.5 Rate time Tv

For Type 3433 Controller versions with derivative-action component, the rate time Tv needs to be set at the restriction (11). The setting depends on the controlled system that is being tuned (section 3.1).

2.1.6 Operating point

Controller modules without integral-action component such as P or PD controllers have an operating point. In Type 3433 Controller Module, it can be adjusted between 0 and 100 % which corresponds to 0.2 to 1 bar by an operating point adjuster (12). The setting depends on the manipulated variable y (section 3.1.1).
In Type 3434 P Controller Module, the operating point is fixed at 0.6 bar.

2.2 Setting the limit switches

Only applies to controller stations with the limit switch option:
To set the limit switches, first release the lock (4, Fig. 2) and open out the indicating unit (5). The contacts can be accessed at the back.

Adjust proximity switches by placing a screwdriver in the clamps between 0 and 100 % of the reference scale and move until a contact is made over the connected switching amplifier.

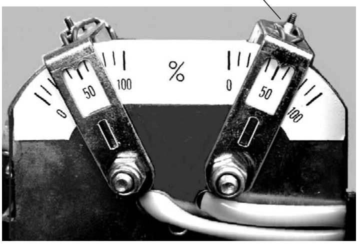


Fig. 3 · Limit switches

3 Commissioning

Prior to commissioning the control loop, check all devices to make sure they are connected correctly, do not leak and function properly.
Release lock (4) and open out the indicating unit (5) to enable easy access to the operating controls at the controller.
Check the turnboard to make sure the correct operating action is set at the controller (see section 2.1.1).

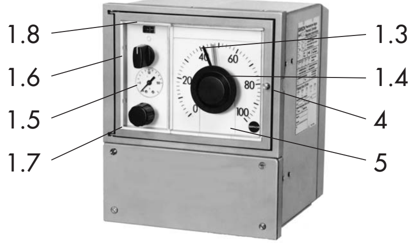
3.1 Tuning the controller

The controller needs to be tuned to the characteristics of the controlled system using the K_P and T_n and/or T_v adjusters at the controller module to ensure that the controller can keep any system deviations for all set points caused by the disturbance variables to zero or at least to minimize them.

In case of controller stations which have a **manual/ automatic switch** (1.6), the plant must be started up manually.

We recommend to determine the settings by using a tuning test (following the Ziegler and Nichols method) which produces sufficient results in most cases:

1. Apply supply air (1.4 ±0.1 bar).
2. Set the proportional-action coefficient K_P to a low value at the comparator.
3. Set T_n restrictor to its maximum value and T_v to its lowest value (applies only to PI and PID controllers).



1.3 Actual value pointer (red)
1.4 Set point adjuster with green pointer
1.5 Signal pressure display
1.6 Manual/automatic switch
1.7 Adjuster for signal pressure (manual)
1.8 Differential pressure indicator
4 Lock
5 Indicating unit

Fig. 4 · Front view

Setting in manual mode:

4. Set manual/automatic switch to **Manual**.
5. Operate manual adjuster (1.7) for the control signal so that the controlled variable (actual value pointer 1.3) slowly settles on the adjusted set point (set point pointer 1.4).
   Should the differential pressure indicator (1.8) move to zero, set the manual/automatic switch (1.6) to **Automatic**.
   Proceed as described in points 6 and 7.

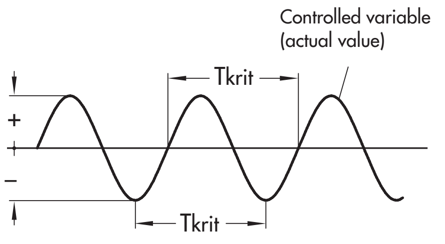
Setting in automatic mode:

4. Set the set point to the required value at the rotary knob (1.4) on the indicating unit.
5. Set the T_n restriction briefly to its lowest value (completely open) to move the red

actual value pointer to the green set point pointer. Close the T_n restriction again.

6. Starting from a low value, increase the proportional-action coefficient K_P until the actual value pointer displays an harmonic oscillation pattern (uniform oscillation amplitudes as shown in Fig. 5) of the controlled variable.
   If oscillations do not arise with a large K_P setting, turn the rotary knob to change the set point slightly and then return it to its former setting. It may be necessary to increase the gain (K_P) slightly until an harmonic oscillation pattern arises.
7. Write down the adjusted value of the K_P scale you have just adjusted as the critical proportional-action coefficient K_{Pkrit}. Use a stopwatch to time the oscillation time for one entire oscillation as T_{krit} (PI and PID controller only).
   Multiply both values with the values in the table (Fig. 5) and set as the favorable settings for K_P, T_n, and T_v at the controller.

Should oscillations still occur despite these settings, slightly reduce K_P and increase T_n. Repeat these steps, if necessary, until the control loop shows a satisfactory performance. Leave enough time in between setting to allow the controller to stabilize.



Cntr.	K_P	T_n	T_v
P	$0.50 \cdot K_{P,krit}$		
PI	$0.45 \cdot K_{P,krit}$	$0.85 \cdot T_{krit}$	
PID	$0.59 \cdot K_{P,krit}$	$0.50 \cdot T_{krit}$	$0.12 \cdot T_{krit}$

Fig. 5 · Harmonic oscillation, settings

3.1.1 Setting the operating point in P and PD controllers

(Type 3433 Controller Module only)

After setting the proportion-action coefficient K_P as described previously, set the operating point for P and PD controllers instead of the reset time T_n.

- Read off the controlled variable yA of the controller at the display (1.5) when the plant is in a steady-state condition and set this value directly at the operating point adjuster (12, Fig. 2). (Setting 0.2 to 1 bar = 0 to 100 %).
- Recorrect slightly until the system deviation is zero. In case the signal pressure display deviates, average the value.

Note!
On changing set point or reference variable, the operating point must be set again as described above.
If the reference variable is changed more often, set the operating point to 0.6 bar = 50 % (average value).

Note!
The T_n restriction must be completely opened with a P/PI controller is switched over to P action to allow the operating point adjuster to work without delay.

Version with w-dependent operating point

This version does not need to be adjusted since the operating point automatically follows the set point w.

3.2 Smooth automatic/manual mode changeover

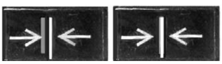
(only for controller station with manual/automatic changeover, Fig. 4)

The smooth switchover ensures that no pressure surges can reach the valve when the manual/automatic switch is activated as follows:

Changeover from automatic to manual

Use the manual adjuster (1.7) to adjust signal pressure manual yH until the differential pressure indicator (1.8) is zero. Switch over to manual at the switch.

Differential pressure indicator



With Without deviation

Changeover from manual to automatic

If the plant is to be controlled manually to the required value, the automatic signal pressure yA must be matched to the manual signal pressure yH by adjusting the set point adjuster (1.4).
The switch (1.6) can only be set to automatic after the differential pressure indicator (1.8) is at zero.

Set the set point again to the required value.

3.3 Smooth changeover between the internal and external reference variable

When combining the fixed set point control and follower control, the Type 3432 Controller Station is equipped with a w_{int}/w_{ext} switch, a pressure adjuster and a differential pressure indicator (Fig. 10).
The differential pressure indicator must first be brought to zero by activating the pressure adjuster in order to switch between the reference variables.

3.4 Readjusting the controller's zero point

Should deviations arise between the actual value and set point during operation, the zero point adjustment can be readjusted by turning the zero screw at the back of the display unit (5) until the actual value and set point on the front display are the same again.

Deviations between the actual value and set point can also be corrected at the zero point adjuster (8, Fig. 2) of the controller module.

4 Construction

The controllers designed according to the modular principle form an entire automation unit consisting of a controller station, a controller module tuned to the local conditions, and, where applicable, a transmitter as well as other additional modules.

Controllers with Type 3432 Controller Station are mainly designed for installation of a Type 3435 Transmitter Module for Pressure or a Type 3436 Transmitter Module for Temperature with direct process fluid connection.
The Type 3431 Controller Station receives the controlled variable as a standardized signal from 0.2 to 1 bar or 3 to 15 psi. The controlled variable can also be supplied as a current signal from 4 or 0 to 20 mA or 1 to 5 mA over an integrated i/p converter.

The controller station can be equipped with the Type 3433 or Type 3434 Controller Module.
For special control applications, the Type 3433 Controller Module can be combined with Type 3437 Additional Modules for pressure limitation, control mode switchover or smooth manual/automatic transfer.
The controller station can also be upgraded, if required, with a manual/automatic transfer, consisting of a selector switch, adjuster for manual mode, and differential pressure indicator.
The controller station must be equipped with an additional module for w_{int}/w_{ext} changeover when used for applications as a combined fixed set point controller and follower controller. An additional pneumatic or electric output for the external reference variable w_{ext} (e.g. 0.2 to 1 bar or 4 (0) to 20 mA) is likewise required when used as a follower controller. Additionally, inductive limit switches, that are adjustable at a scale, can be mounted on the indicating units 1 or 2.

Note! Refer to the corresponding Data Sheets for details about the controller stations and their controller modules.

T 7030 EN · Pneumatic Indicating Controllers - Information Sheet with product overview.

T 7032 EN · Pneumatic Indicating Controllers for Pressure

T 7034 EN · Pneumatic Indicating Controllers for Temperature with Capillary Sensor

T 7036 EN · Pneumatic Indicating Controllers for Temperature with Pt 100 Resistance Thermometer

T 7038 EN · Pneumatic Indicating Controllers for Standardized Signals

T 7040 EN · Type 3433 Pneumatic Controller Modules and Type 3437Additional Modules

T 7041 EN · Type 3434 Pneumatic Controller Modules

T 7045 EN · Type 6112 i/p Converter Module

5 Principle of operation

5.1 Transmitter modules

Type 3435 for Pressure
The process fluid pressure p is transmitted to the transmitter module (2) where it causes a deflection at the Bourdon tube measuring

system (2.1). The deflection is converted by the pneumatic servo system (2.2) into a pneumatic signal (controlled variable x) which is proportional to the pressure p. The signal is transferred to the bellows measuring system of the actual value display (1.3) as well as to the controller module (3).

Type 3436 for Temperature with capillary sensor

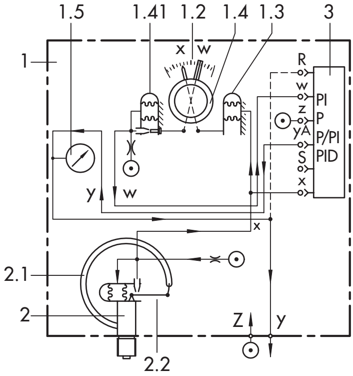
The temperature of the medium produces a pressure in the gas-filled sensor (2.3) of the transmitter module which is proportional to the temperature. This pressure is offset by a force on the beam (2.4) and converted into the output pressure p_A at the feedback bellows (2.6).
The supply air flows over the restriction (2.9) and nozzle (2.8) and hits the flapper (2.7). As the temperature rises, the flapper moves closer to the nozzle. This results in an increase in output air pressure p_A supplied to the bellows (2.6) until a new state of equilibrium is reached, i.e. until the output signal is proportional to the temperature measured. This signal is transmitted as the actual value signal (controlled variable x) to the bellows measuring system of the actual value display (1.3) and the controller module (3).

Type 3438 for Temperature with Pt 100 resistance thermometer

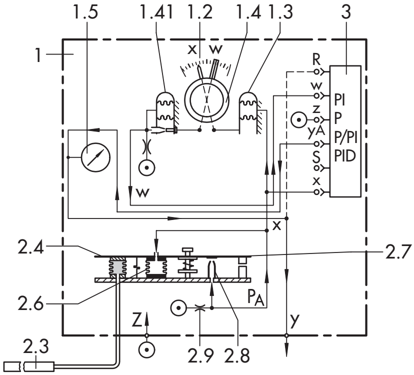
The Type 3438 Transmitter Module consists of an electric transmitter and a downstream i/p converter to connect a Pt 100 sensor. The resistance value of the Pt 100 sensor is converted into a 4 to 20 mA current signal in the electric transmitter. Its output signal (4 to 20 mA) is converted into a pneumatic signal between 0.2 and 1 bar by the i/p converter. The output pressure, which is proportional to the temperature, is supplied to the bellows measuring system of the controlled variable display and the controller module as a pneumatic controlled variable signal (controlled variable x).

5.2 Controller station

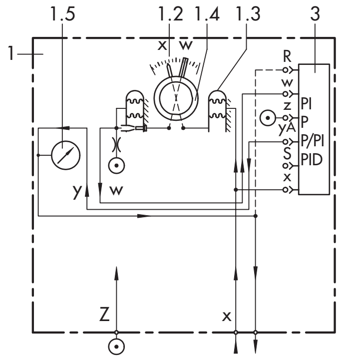
The actual value signal x causes a deflection at the bellows measuring system of the actual value display (1.3) which is transmitted to the pointer over a gear mechanism.
The set point (reference variable w) can be adjusted at the scale (1.2) on the front. The position of the set point adjuster (1.4) is transmitted to the set point transmitter over a gear mechanism. This pneumatic servo system (1.41) converts the adjusted set point into a pneumatic set point signal (w) which is transmitted to the controller module.
The controller module compares the actual value signal (x) with the set point signal (w) and controls using the control signal yA depending on the system deviation and the adjusted control parameters. The control signal is connected to the signal pressure display (1.5) and the output port y.
The controller station with manual/automatic switchover (Figs. 2 and 4) additionally features a manual/automatic switch (1.6), an adjuster for manual mode (1.7), and a differential pressure indicator (1.8).
Signal pressure display (1.5) and output port y are connected to the automatic output signal y_A with a switch position at “Automatic” and to the manual output signal y_H set at the adjuster (1.7) with a switch position at “Manual”.
A smooth switchover from manual to automatic mode is possible when the differential pressure indicator (1.8) shows that y_A and y_H are identical.



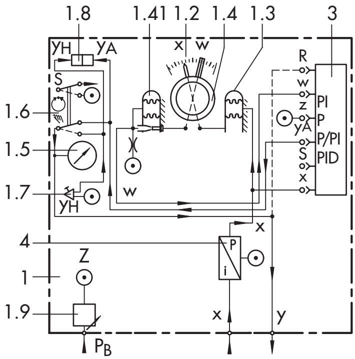
Type 3432 with Type 3435 Transmitter for Pressure



Type 3432 with Type 3436 Transmitter for Temperature



Type 3431 and 3432 for pneumatic standardized signals



Type 3432 with manual/automatic switch (1.6), supply pressure regulator (1.9) and i/p converter

1 Controller station
1.2 Scale
1.3 Actual value display with pointer, gear mechanism and bellows measuring system
1.4 Set point adjuster with pointer, gear mechanism and set point (1.41), set point display only for follower controllers
1.5 Signal pressure display
1.8 Differential pressure indicator for smooth manual/automatic switchover
1.9 Supply pressure regulator
2 Transmitter module
2.1 Bourdon tube meas. system
2.2 Pneumatic servo system
2.3 Temperature sensor
2.4 Beam
2.6 Feedback bellows
2.7 Flapper
2.8 Nozzle
2.9 Restriction
3 Controller module
4 Type 6112 i/p Converter

⊙ Z = Supply pressure 1.4 bar
P_A = Output pressure
P_B = Compressed air network

Fig. 6 · Principle of operation of controllers

5.3 Controller modules

The controller modules are designed as plug-in units. They are inserted into the self-sealing hose fittings of the controller station and fastened in place by mounting screw.

5.3.1 Type 3433 Controller Modules

The controller modules consist of the comparator equipped with four metal bellows arranged in a square and the base plate with plug-in connections. The base plate contains the components necessary for the corresponding function such as relays and restrictors. The components can be exchanged or retrofitted to upgrade a device (refer to section 9.1 for more details).

Type 3433-2 PI Controller (Fig. 7, top)

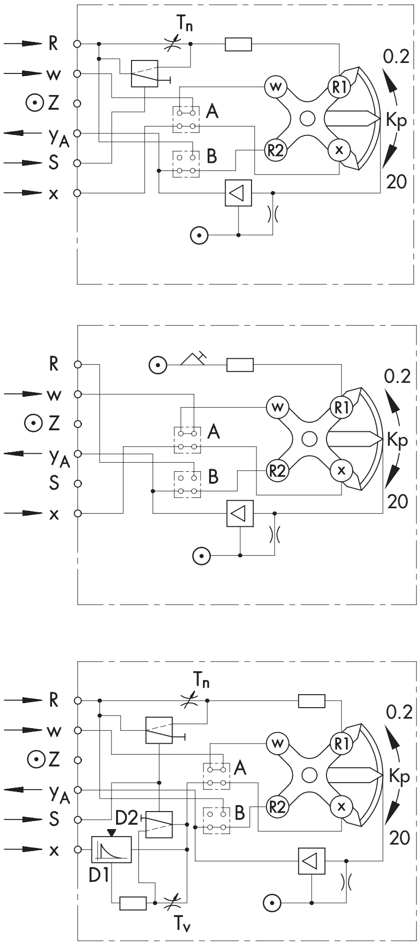
The controlled variable x (actual value) and the reference variable w (set point) are transmitted as pneumatic signals between 0.2 and 1 bar to metal bellows w und x over the turnboard **A**. When x is greater than w, the actual value bellows tilts the swashplate at its pivot towards the set point bellows. This causes the pressure to rise downstream of the nozzle which is connected to the swashplate over a pin and, as a result, the comparator increases the output pressure y_A. The output pressure is fed back over turnboard **B** to the bellows R2 on the swashplate.
The pressure and the position of the swashplate continue changing until the distance between the nozzle and flapper achieve the initial value and the output pressure y_A reaches the value related to the controlled variable x and the proportional-action coefficient K_p set at the screw.

Outside of the controller module, y_A is connected to R, meaning that the output pressure y_A is also fed back to bellows R1 over port R and the adjustable T_n restriction. As a result, the effect caused by the pressures in bellows R1 and R2 is balanced and system deviation is eliminated.

Should a switching pressure exist at port S after switching the controller station to manual mode, the T_n restriction is bypassed by the T_n start-up relay.

Turnboard A determines the operating action of the controller which can be changed by turning the board. Refer to section 2.1.1.

Turnboard B determines the air supply to the feedback bellows.
In delivered state, it is set to $\mathbf{y_A}$, i.e., the output pressure is directly fed back to bellows R2, whereas, it is fed to bellows R1 over the manual control unit to port R. This arrangement provides the controller with a normal air supply and a damping of the output pressure.
Setting it to **R** results in the output pressure y_A being fed back to bellows R1 and R2 over port R which provides a higher air supply.
This type of turnboard setting is suitable for applications where the distance to the final control element is long and the connected volume is large as well as where controlled systems react quickly. Refer to section 2.1.2 to set or change the air supply by turning the turnboard **B**.



R Feedback
R1/R2 Feedback bellows
⊙ Z = Supply air 1.4 bar
Y_A Output pressure
S Switching pressure

Turnboards
A Operating action
B Air supply

Fig. 7 · Type 3433 Controller Modules

Type 3433-2 PI Controller Module
The following versions of the controller modules are similar in most aspects to the Type 3433-2 PI Controller Module, however, they are fitted with, for example, an operating point adjuster, derivative element, or a selector switch, depending on the application.

Type 3433-1 P Controller Module
corresponds to Type 3433-2.
An operating point adjuster is used in place of the integral element.

Type 3433-3 PID Controller Module
corresponds to Type 3433-2.
Additionally, it contains a derivative element which produces the rate action with approximately ten times the gain in the input branch of the controlled variable x. The rate time can be adjusted at the T_V restriction.

Type 3433-4 PD Controller Module
corresponds to Type 3433-1.
Additionally, it contains a derivative element which produces the rate action with approximately ten times the gain in the input branch of the controlled variable x. The rate time can be adjusted at the T_V restriction.

Type 3433-5 P/PI Controller Module
with P/PI selector switch can optionally be used as a P controller with operating point adjustment or as a PI controller.
The structure is the same as that of the PI and P controller module.
Type 3433-6 PD/PID Controller Module with PD/PID selector switch can optionally be used as a PD or PID controller.

Type 3433-9 P Controller Module
with set point-dependent operating point corresponds to Type 3433-1 P Controller Module, except that the operating point shifts proportional to the set point w.

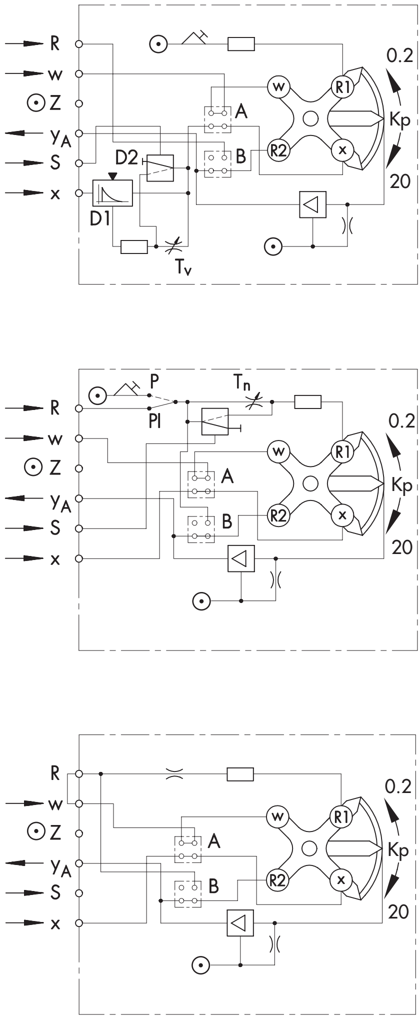


Fig. 8 · Type 3433 Controller Modules

5.3.2 Type 3434 Controller Modules

The controller modules have a round comparator which operates according to the force-balance principle.
The proportional-action coefficient K_p can be adjusted in the range between 1 and 25.

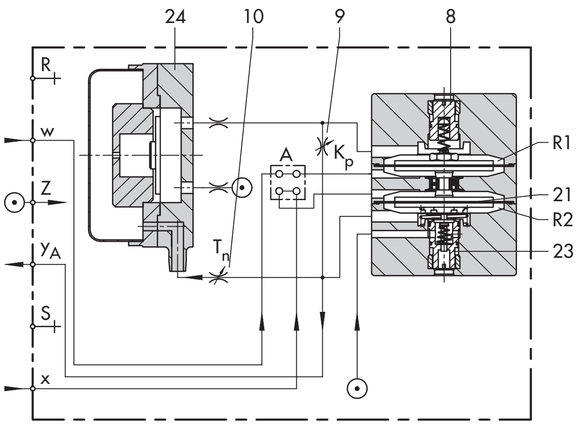
Type 3434-2 PI Controller Module (Fig. 9)

Controlled variable x and reference variable w are transmitted as pneumatic excess pressures between 0.2 and 1 bar or 3 and 15 psi to the diaphragm chambers (R1 and R2) over the turnboard **A**. When x is greater than w, the force switch (23) lowers and the plug opens. Supply air flows into the diaphragm chamber R2 and the output pressure y_A increases. This pressure is transmitted over the T_n restriction (10) to the volume of the 1:1 booster (24). Its output pressure is fed back to the diaphragm chamber R1.

The effect caused by the pressures in the diaphragm chambers R1 and R2 is balanced. The position of the force switch continues to change until the controller output pressure reaches a value which is related to the controlled variable x and the adjusted proportional-action coefficient K_p, i.e. until the system deviation is eliminated.
The proportional-action coefficient K_p is adjusted at the restriction (9) and the reset time T_n at the restriction (10). The zero point adjuster (8) is used to tune the device.
The turnboard **A** determines the controller's operating action which can be changed by turning the board (section 2.1.1).

Type 3434-1 P Controller Module

The design and principle of operation are the same in most aspects to Type 3434-2 PI Controller Module.
However, a spring for an operating point fixed at 0.6 bar is used instead of the feedback with T_n restriction.



8 Zero point adjuster
9 K_p adjuster
10 T_n adjuster
21 Diaphragms
23 Force switch
24 Booster

R1 Diaphragm chamber
R2 Diaphragm chamber
A Turnboard for operating action

Fig. 9 · Type 3434-2 Controller Module

5.4 Additional modules

5.4.1 Type 6112 i/p Converter

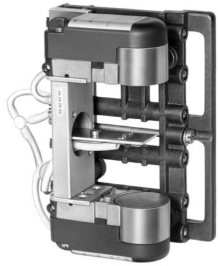
External reference variable w_{ext} and/or controlled variable x can be issued as a current signal of 4(0) to 20 mA or 1 to 5 mA and converted by the i/p converter into a pneumatic standardized signal of 0.2 to 1 bar.
The i/p additional module with one or two converters is integrated into the controller station and can only be used in conjunction with the Type 3433 Controller Modules.

5.4.2 w_{int}/w_{ext} selector switch

When used as a combination of fixed set point controller and follower controller, the controller is fitted with a w_{int}/w_{ext} selector switch.
The associated set point adjuster and differential pressure indicator allow a smooth switchover when the indicator is at zero. Refer to section 3.3.

5.4.3 Supply pressure regulators

When a supply pressure regulator is mounted onto the Type 3432 Controller Station, it is suitable for the connection to an operating pressure of 2.0 to 12 bar.
The Type 3708-5003 Supply Pressure Regulator (Var.-ID 1023317) reduces and controls the operating pressure to the required supply pressure of 1.4 bar.



Connecting plate with two i/p converters
for controlled variable x and external set point



Adjuster for internal set point

w_{int}/w_{ext} selector switch



Supply pressure regulator

Fig. 10 · Additional modules

5.4.4 Inductive limit switches

The inductive limit switches indicate when the controlled variable x exceeds and/or falls below an adjustable limit value.

Two metal tags are mounted to the pointer shaft of the controlled variable x which activate associated proximity switches.
When the metal tag moves into the field of the inductive pick-up, it is highly resistive and when the metal tag moves outside of the field, it is low resistive.

The proximity switches are located in adjustable brackets. The required switching point can be adjusted by turning the brackets. Refer to section 2.2 for more details.

6 Installation

6.1 Mounting

The controller station is designed for mounting onto pipes, walls or in panels.
Refer to Figs. 11 and 12 for the corresponding dimensions.

Pipe mounting
Mounting to vertical or horizontal 2" pipes using a mounting part with bracket.
Required mounting kit:
Order no. 1400-6302.

Protective roof (accessories):
Order no. 1400-6311

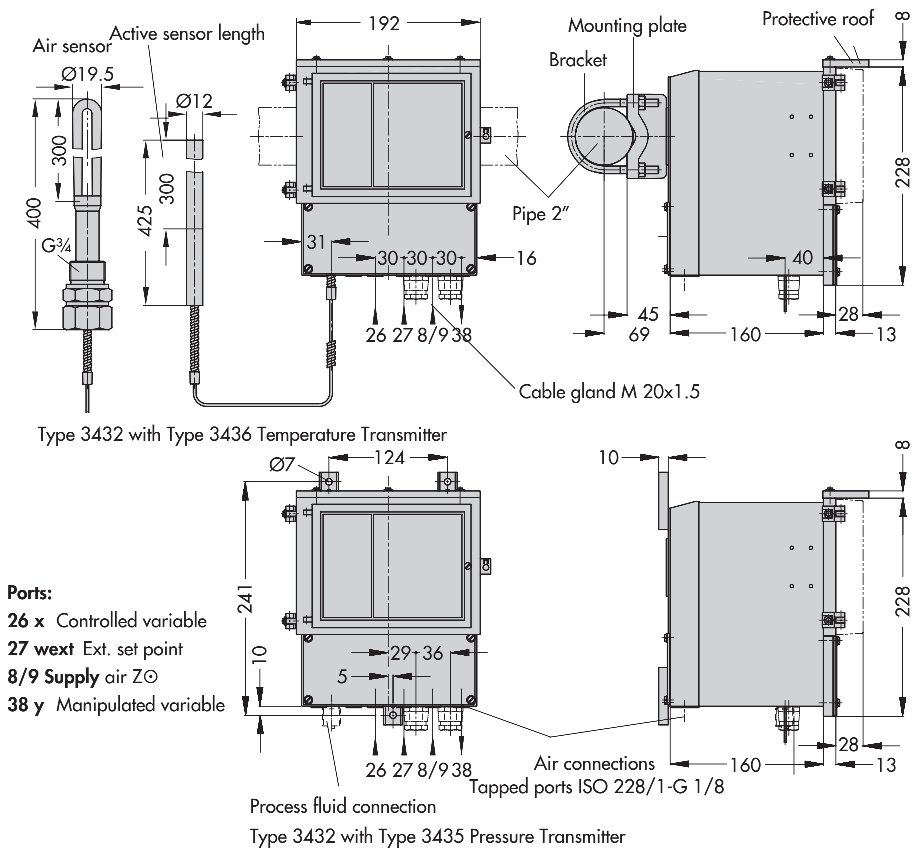


Fig. 11 · Installation dimensions of Type 3432 Controller Station

Wall mounting
Mounting using three straps
Required mounting kit: Order no.1400-6301

Panel mounting
Mounting using four mounting elements (DIN 43835).
Distance between centers to door approx. 235 mm.
Close arrangement in rows without door acc. to DIN IEC 61554 (DIN 43700).

Type 3432:
Panel cut-out 188^{+1} x 255^{+1} mm,
Required panel mounting kit:
Order no. 1400-6300.

Type 3431:
Panel cut-out 188^{+1} x 138^{+1} mm,
Required panel mounting kit:
Order no. 1400-6303

Protective roof (accessories):
Order no. 1400-6311

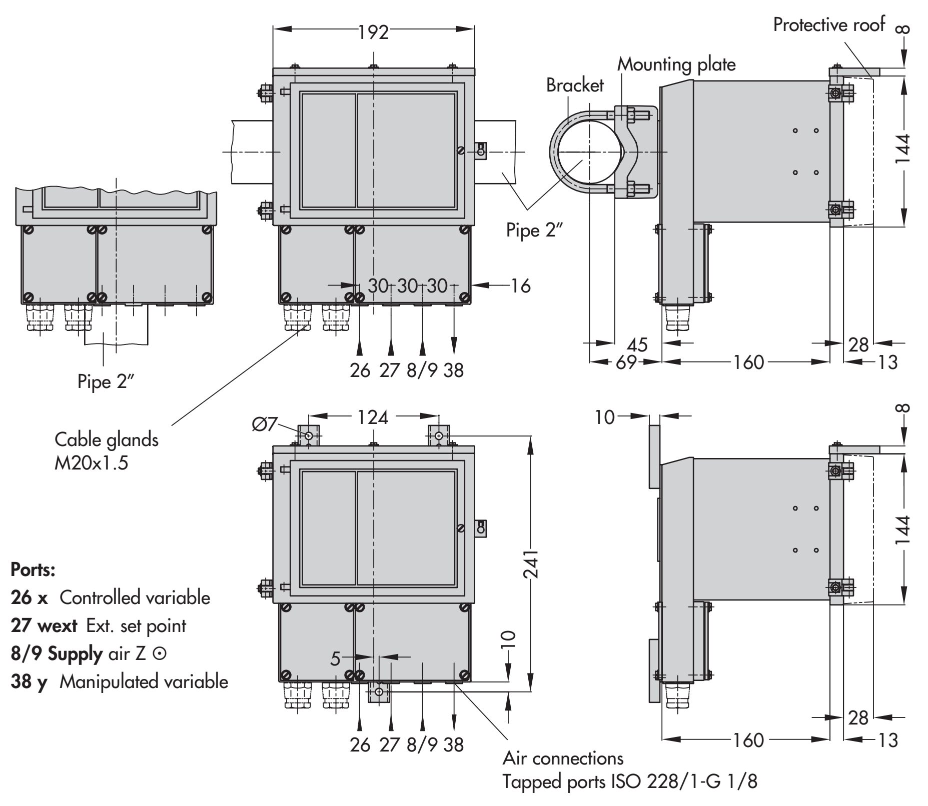


Fig. 12 · Installation dimensions of Type 3431 Controller Station

6.1.1 Changing scales

After unlocking the door (4, Fig. 4), the scale can be removed from the back of the display and, if necessary, replaced with a special scale.
The scale division of the scale must match the measuring range of the connected or integrated transmitter.

Adhesive strips are attached to inside the casing for tag labeling on the scale.

- Cut the strips to size and stick them on the scale.

6.2 Installing the temperature sensor

Only applies to controller stations with Type 3436 Transmitter Module

Bulb sensor Ø 12 mm, length 425 mm (active length 300 mm)

The bulb sensor can be installed in any position. However, the entire length of the sensor must be immersed in the medium to be controlled.

Choose a point of installation where overheating or noticeable time delays cannot occur.
Run the capillary tube in such a way that the large temperature deviations cannot occur (ambient temperature approx. 20 °C) and the tube cannot be damaged.
The smallest possible bending radius is 50 mm.

A sleeve with G ½ or G ¾ female thread at the point of measurement is required to install the sensor. Screw or seal one of the mounting parts shown in Fig. 13 into this sleeve.

Note!
The mounting parts are not included with the sensor. They must be ordered separately. Select which mounting parts are needed depending on the operating conditions at the point of measurement.

Mounting parts for bulb sensor Ø 12 mm, length 425 mm

Clamping flange

For wall mounting, e.g. pressureless containers or ducts

Order no. 1090-9547

Mount flange to wall using two screws and attach temperature sensor with two other screws in the flange.

Screw gland (PN 10)

G ½ Order no. 1080-4881
G ¾ Order no. 1080-4882

Fill screw fitting with sealant. Insert sensor with screw gland and coupling nut.
Tighten coupling nut.

Screw gland (PN 40) with clamping nut

G ½ Order no. 1080-4884
G ¾ Order no. 1080-4885

Install as described above. Tighten clamping nut instead of coupling nut.

Thermowell with thread (PN 63)

G ½ Order no. 1080-4888
G ¾ Order no. 1080-4889

Use a thermowell when the nominal pressure is exceeded, when corrosive media are involved or when the plant is to continue to run while the sensor is being replaced.

Insert sensor right to the bottom of the thermowell.
Tighten coupling nut.

Thermowell for welding (PN 63)

Order no. 1080-4890

Thermowell with flange

Order no. 1080-4891 (PN 40)
1080-4892 (PN 100)

Note: All wetted parts of the screw gland and thermowells are made of stainless steel 1.4571.

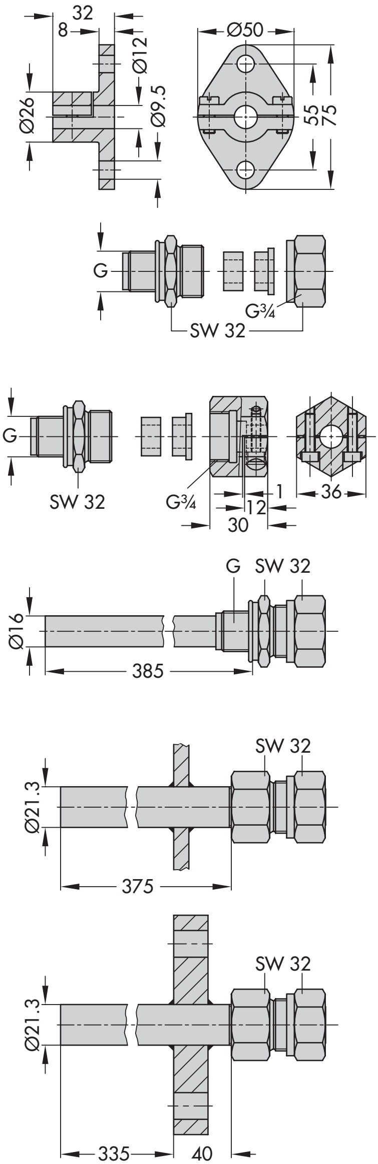


Fig. 13 · Mounting parts for bulb sensor

7 Connections

7.1 Pneumatic connections

The air connections underneath the device are designed as bores with ISO 228/1-G 1/8 thread. The customary fittings for pipes or plastic hoses can be used.

Note!
The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.
Blow through all air tubes and hoses thoroughly prior to connecting them.

The connection designations with codes are cast underneath the housing.
They can additionally be marked on the back of the housing using the adhesive label supplied with the controller station.

38 Output y – Manipulated variable,
Output signal of the controller to operate the control valve or positioner.

8/9 Supply – Supply air ⊙,
Supply air 1.4 ±0.1 bar or 2 to 12 bar for the version with supply pressure regulator (see section 5.4.3).

27 Input w_{ext} – External reference variable,
Closed with fixed set point controller and **open** for the connected external set point with follower controller.

26 Input x – Controlled variable,
Closed with pressure or temperature controller (controlled variable is recorded by the transmitter module).
Open with standardized controllers.

7.1.1 Typical applications

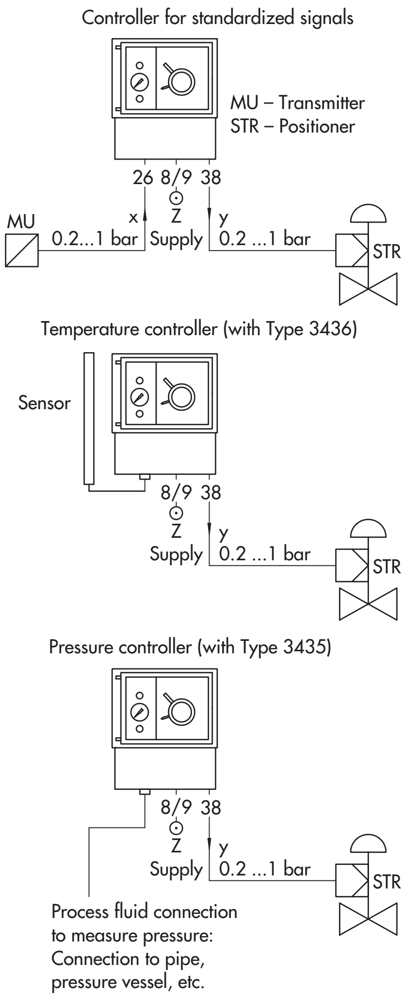


Fig. 14 · Standard applications

7.1.2 Adjusting the supply air for version with supply pressure regulator

Only applies to Type 3432 Controller Stations with supply pressure regulator (1.9).

Hose connections for supply air are located directly above the corners of the supply pressure regulators on the bridge of the connecting plate (inside housing). The connections are sealed by the hose end fittings.

- Pull left end fitting off and use a hose to connect it to a test pressure gauge.
- Controller stations with a manual/automatic selector switch have a test connection (yellow) inside the indicating unit. Use the enclosed test connector for this version (Fig. 15).
- Unscrew cap of the pressure controller. Undo the lock nut on the spindle and adjust the spindle:

- Turn the spindle clockwise to increase the supply pressure and counterclockwise to reduce it.

- Secure the position of the spindle with the lock nut and screw the cap back on when the supply pressure at the test pressure gauge indicates a pressure of 1.4 ±0.1 bar (20 ±1.5 psi).

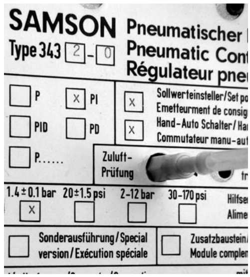


Fig. 15 · Test connection with test connector

7.2 Electrical connection

The electrical components only apply to controller stations with i/p converter additional modules for controlled variable x, external reference variable wext and/or with inductive limit switches.

⚠ ***Caution!***
For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance association.
The following standards apply for assembly and installation in hazardous areas: EN 60079-14: 2003 (VDE 0165 Part 1/8.98) ***"Electrical apparatus for explosive gas atmospheres"*** *and EN 50281-1-2: 1999 (VDE 0165 Part 2/11.99)* ***"Electrical apparatus for use in the presence of combustible dust"****.*
For the interconnection of intrinsically safe electrical equipment, the permissible maximum values specified in the EC type examination certificate apply (U_i or U_0; I_i or I_0; P_i or P_0; C_i or C_0, and L_i or L_0).
Note! *The terminal assignment specified in the Mounting and Operating Instructions must be adhered to. Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective. Do not tamper with painted screws.*

Note on the selection of cables and wires*:*
To install intrinsically safe circuits, observe section 12 of the standard EN 60079-14: 2003 (VDE 0165 Part 1).
To run multi-core cables or lines with more than one intrinsically safe circuit, section 12.2.2.7 of this standard applies.
Devices used at ambient temperatures down to –40 °C must have metal cable entries.

The terminals on the base plate can be accessed after unscrewing the front cover beneath the display. For operation of the limit switches, switching amplifiers which comply with EN 60947-5-6 must be connected in the output circuit.

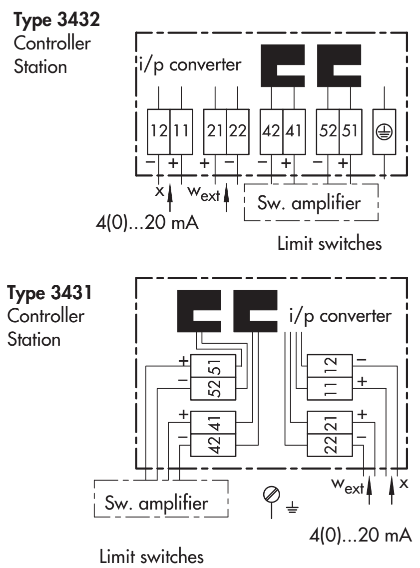


Fig. 16 · Connecting i/p converters and limit switches

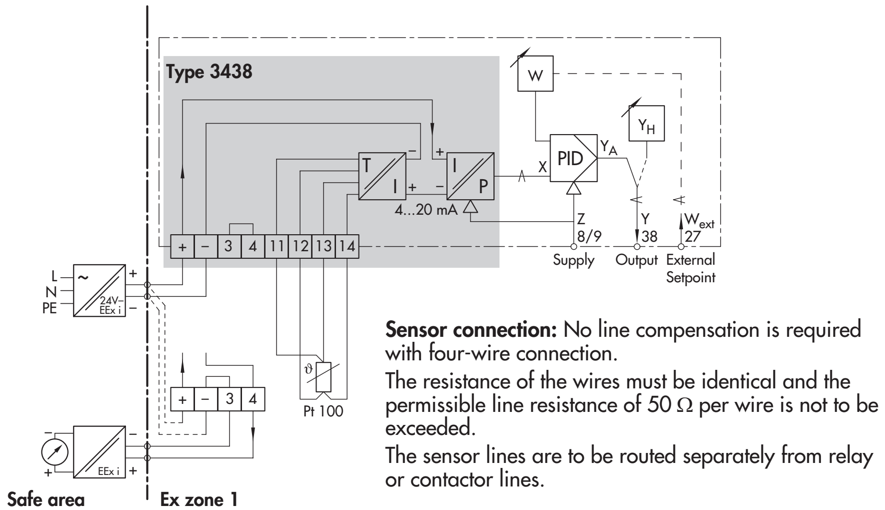


Fig. 17 · Electrical wiring of Type 3432 Controller Station with Type 3438 Transmitter Module

8 Maintenance

8.1 Checking the air supply

The modules of the pneumatic controllers normally do not require any maintenance. However, the air supply should be checked regular intervals.
The proper functioning of the device can only be guaranteed when the compressed air supplied to the device is always in a clean condition.
Check the air filter and traps of the reducing station at regular intervals. If necessary, when the performance worsens, clean or replace the appropriate filters.

Transmitter module:
A hose grommet fitted on the hose for supply air which includes a filter.
This filter needs to be cleaned or replaced when the display for the controlled variable does not work (order no. 0550-0193).

Type 3433 Controller Module:
In case the controller module does not control properly or there is no output signal, unscrew the restriction (7, Figs. 2 and 17) on the left side underneath the comparator and clean or replace it (order no.1390-0183).
Pull out the filter, if need be, and replace it (order no. 0550-0193).
The hose connections of the controller module are also fitted with filters (order no. 0550-0186).
Additionally, the ports underneath the housing are fitted with plastic-rimmed filters which can be unscrewed and cleaned (order no. 0550-0189).

9 Conversion

9.1 Changing the controller function

The controller function can be changed either by exchanging the entire module (Type 3434-1 or Type 3434-2) or by upgrading or altering (Type 3433) components such as adjusters, restrictions or differential amplifier.

Type 3433 Controller Module:

- Unscrew the mounting screw (6) at the controller module and pull it off the self-sealing hose fittings. Remove it from the controller station.
- Undo bolts (3.3) and pull connecting plate (3.2) together with bolts and hex nuts off the controller module.
- Detach and mount the corresponding cover plates and adjusters by unfastening the M3 hexagon socket head screws inside the housing.

P into PI: Unscrew adjuster for operating point (12) and replace it with T_n restriction (10).

P into P/PI: Unscrew adjuster for operating point (12) and replace it with a selector switch with operating point adjuster (13) and T_n restriction (10).

P into PD: Unscrew cover plate (14.1). Take out O-ring (14.3) and insert two O-rings (14.4) in its place. Screw on differential

Part	Quantity	Designation	Order no.
10	1	T_n restriction	1070-4584
10.1	2	Screws M3x8	8333-0479
10.2	3	O-rings 1.78 x 1.02	8421-0010
11	1	T_v restriction	1070-4585
11.1	1	Cover plate	0360-1597
11.2	2	Screws M3x8	8333-0479
11.3	4	O-rings 2 x 1.5	8421-0023
12	1	Operating point adjuster 1.4 bar	1070-4583
12	1	20 psi	1070-6413
12.1	2	Screws M3x8	8333-0479
12.2	4	O-rings 1.78 x 1.02	8421-0010
13	1	Selector switch with operating point adjuster	1180-3615
13.1	2	Screws M3x30	8333-0482
13.2	4	O-rings 1.78 x 1.02	8421-0010
14	1	Differential amplifier	1080-6924
14.1	1	Cover plate	0360-1598
14.2	1	Screws M3x16	8333-0476
14.3	1	O-ring 14 x 1.5 for plate	8421-0070
14.4	4 (2)	O-rings 2 x 15	8421-0023
15	1	Plate with restriction for set point-dependent operating point	1590-1089

amplifier (14). Unscrew cover plate (11.1) and mount T_v restriction (11).

P into PID: Modify as described for P into PD. Additionally, replace adjuster (12) with T_n restriction (10).

P controller with set point-dependent operating point: Fasten the plate with restriction (15) in place of the adjuster for operating point (12).

Note!
We recommend replacing old O-rings as well as the filter in the restriction (7) with new ones.

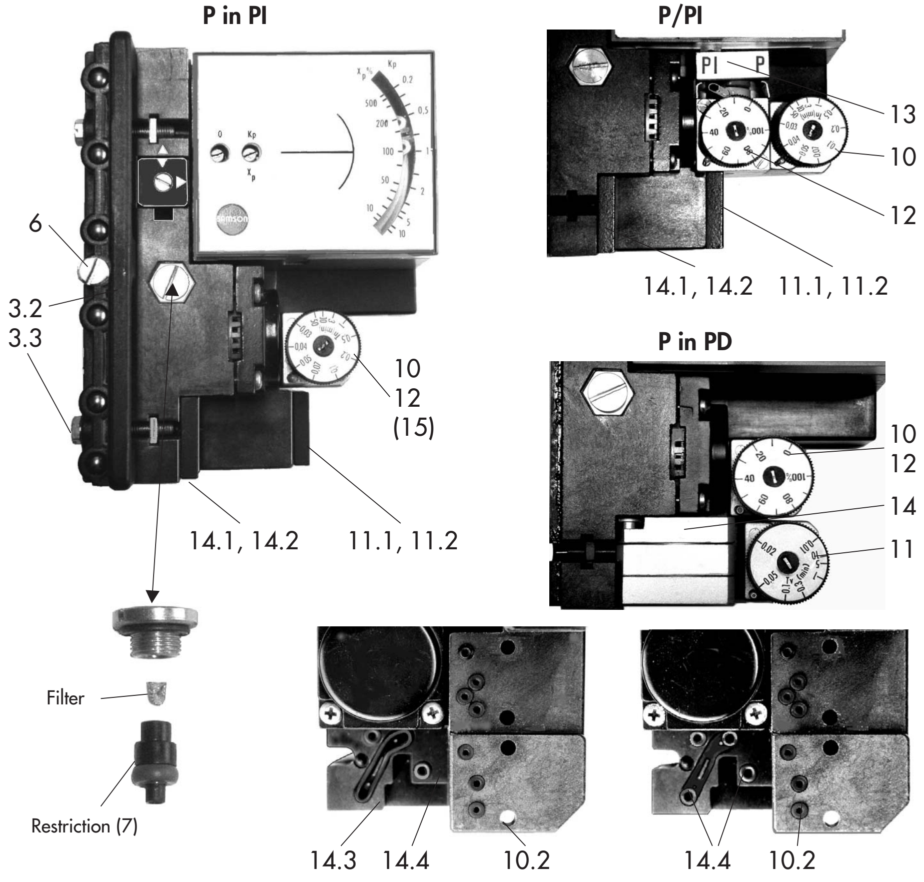


Fig. 18 · Changing the controller function of Type 3433

9.2 Exchanging the transmitter module

The Type 3435 and Type 3436 Transmitter Module are fastened to the Type 3432 Controller Station over six screws.
The supply air **x** is connected over two silicone hoses.

The transmitter module can be replaced when a measuring element is defective or the measuring range is to be changed. When you order a new module, you need to provide information on the sensor version and the required measuring range. In addition, please state the specifications contained on the nameplate of the old transmitter module.

1 Unscrew the front plate located underneath the display. Unfasten the corresponding terminals for modules with electrics.
2 Pull off the hoses for controlled variable **x** and supply air **Z** on the housing connecting plate.
3 Unfasten the six mounting screws on the bottom of the controller station and remove the transmitter module.
4 Mount the new transmitter in the reverse order.

   On attaching the hoses to ports **x** and **Z,** it is important not to get them confused. The supply air hose is fitted with a hose grommet which contains a restriction and filter.

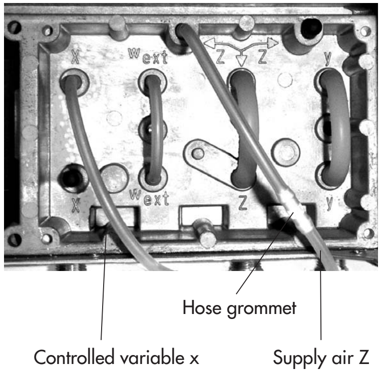


Fig. 19 · Connecting plate

9.3 Checking the controller function

To check the controller, the controlled variable and the manipulated variable must be bypassed at the ports **x (26)** and **y (38)** on the bottom of the controller station.

Set the turnboard **A** to
◀ ▶ increasing/decreasing,
the T_n restriction to "fully open" and
the T_v restriction to "closed".

- Change the reference variable at the set point knob over the entire range. If the controller works properly, the controlled variable pointer (red) and the manipulated variable pointer (small pressure gauge) follow the reference variable over the whole display range.

10 Use in hazardous areas

The Type 3430 Controller Station is suitable for use in potentially explosive atmospheres in Zones 1 and 2, even though it does not have its own EC-type examination certificate. The controller station does not require an EC-type examination certificate according to 94/9/EC (ATEX).

Conditions for **use in hazardous areas:**

- The controller station is not marked as an explosion-protected device with the corresponding approval mark.
- All installed explosion-protected modules possess their own EC-type examination certificate.
- The maximum values specified in the associated EC-type examination certificate apply to the connection to intrinsically safe circuits.
- The installation, wiring, terminals, cable entry and other components relevant for explosion protection comply with DIN EN 50014, DIN EN 50020 and DIN EN 60079-14 (VDE 0615).
- The transparent door or window of the controller station has a conductive coating to prevent electrostatic charging.
- The measuring circuit of the transmitter model TTH200-E1H has a protection level corresponding to “ia” and can be connected to sensors which are routed into Zone 0. The transmitter itself must be installed in areas of Zone 1 or Zone 2.

Caution!
Observe the following for installations in potentially explosive atmospheres: On installing and performing service work on the device, ensure that no electrostatic charging can arise due to the high surface resistivity ($R_{insul.} = 10^{12}$ ohm).

10.1 Servicing explosion-protected devices

If a part of the apparatus on which the explosion protection is based needs to be serviced, it must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.

Inspection by an expert is not required if the manufacturer performs a routine check on the device prior to putting it back into operation. The passing of the routine check must be documented by attaching a mark of conformity to the device.

Explosion-protected components may only be replaced by original, checked components from the manufacturer.

Devices that have already been used outside of hazardous areas and are intended for use in hazardous areas in future must comply with the safety demands placed on repaired devices. Prior to operation, they must be tested according to the specifications stipulated for "Repairing explosion-protected devices".

11 Technical data

Type 3432 and Type 3431 Controller Station									
Actual value display	Measuring range 0.2 to 1.0 bar (3 to 15 psi) · Accuracy class 1.6 · Scale length 212 mm								
Set point adjustment	Output 0.2 to 1.0 bar (3 to 15 psi) · Scale length 212 mm · Accuracy class 1.6								
Adjuster for manual mode	Output 0.2 to 1.0 bar (3 to 15 psi) · Max. 0.02 to 1.35 bar · Max. air supply: >1.5m_n^3/h								
Limit switches	1 or 2 SC 3,5-NO-YE proximity switches acc. to DIN EN 60947-5-6 (NAMUR) Type of protection Ⓔx II 2 G EEx ia IIC T6 (PTB 99 ATEX 2219 X)								
i/p converter	Input 4 (0)...20 mA, output 0.2 to 1 bar or 3 to 15 psi for controlled variable x or external set point w_{ext}								
Upgradable with									
Contr. Module Type	**3434-1**	**3434-2**	**3433-1**	**3433-2**	**3433-3**	**3433-4**	**3433-5**	**3436-6**	**3433-9**
Controller function	P	PI	P	PI	PID	PD	P/PI	PD/PID	P
Proportional-action	K_p = 1 to 20		K_p = 0.2 to 20 (0.4 to 40)						
Reset time T_n [min]	–	0.05...20	0.03 to 50						
Rate time [min]	–		0.01 to 10 · Derivative-action gain of x: approx. 10						
Optionally with **Additional Module Type**			Signal Limiter **3437-1**		Control Mode Selector Switch **3437-2**		Manual/auto Transfer Switch **3437-3**		
Output	0.2 to 1 bar (3 to 15 psi) · Max. 0.02 to 1.35 bar								
Supply air	Standard version: Supply air 1.4 bar ± 0.1 bar (20 psi ± 1.5 psi) Air consumption < 0.6 m_n^3/h With supply pressure regulator: Operating air 2.0 to 12 bar (30 to 180 psi) Air consumption < 0.75 m_n^3/h With i/p converter: w_{ext}: +0.13 m_n^3/h								
Air quality acc. to ISO 8573-1	Max. particle size and density: Class 3 · Oil content: Class 2 · Pressure dew point: Class 3 or at least 10 K beneath the lowest ambient temperature to be expected								
Perm. ambient temp.	–20 °C to +60 °C (–40 °C to +60 °C on request)								
Degree of protection	IP 40, IP 65 front with door								
Total weight, approx.	6 kg								
Type 3435 Transmitter Module for Pressure									
Measuring range [bar] (set point range)	0 to 1.6	0 to 2.5	0 to 4	0 to 6	0 to 16	0 to 25	0 to 40		
Overloadable up to	1.25 times the upper measuring range value								
Ultimate strength up to	Double times the upper measuring range value (max. 63 bar at 0 to 40 bar)								
Performance	Deviation from terminal-based linearity: ≤ 0.3 % with terminal-based conformity Hysteresis: ≤ 0.5 % · Overloading to permissible value: ≤ 0.1 %								
Influence	Ambient temperature: ≤ 0.04 %/°C Supply air: ≤ 0.25 %/0.1 bar Overload on permissible value ≤ 0.1 %								

Type 3436 Transmitter Module for Temperature				
Measuring span °C	50	100	150	200
Measuring limit °C	–40 to +200 or 150 to 300	–40 to +300		
Standard ranges °C	–20 to +30	0 to 100	50 to 100	0 to 200
Overload limit	350 °C			
Perm. pressure at sensor	Without thermowell: PN 16		With thermowell PN 63 or PN 100	
Supply air	Supply air 1.4 ± 0.1 bar (20 ±1.5 psi)			
Output	0.2...1.0 bar (3...15 psi)			
Deviation from terminal-based linearity	0.6 % with terminal-based conformity			
Hysteresis	< 0.25 %			
Influence	Supply air: < 0.25 %/0.1 bar			
Pressure at sensor	< 0.6 %/10 bar	< 0.25 %/10 bar		< 0.15 %/10 bar
Ambient temperature	< 0.6 %/°C	< 0.03 %/°C		

Type 3438 Transmitter Module, consisting of Temperature Transmitter **TTH200-E1H** with **Type 6112-22** i/p Converter Module

Electric Temperature Transmitter TTH200-E1H	
Input	Pt 100 resistance thermometer (RTD)
Measuring ranges	–30 to 60 °C, 0 to 40 °C, 0 to 100 °C, 0 to 150 °C, 0 to 200 °C, 0 to 400 °C, other ranges on request
Connection	Four-wire circuit, resistance per wire < 50 ohm
Measuring current	< 0.3 mA
Output	4 to 20 mA, linear to temperature
Current consumption	< 3.5 mA
Maximum output current	23.6 mA
Supply voltage	Two-wire system: Power supply lines = Signal lines
Use in safe area	U_S = 16 to 30 V_{DC}
Use in hazardous area	U_S = 16.5 to 28 (25) V_{DC}, see EC-type examination certificates
Max. load R_B	The supply voltage U_S determines the max. load: $R_B < \frac{(U_S - 16.5\ V)}{0.022\ mA}$
Explosion protection	Ex II 2(1) G EEx [ia] ib IIC T6 acc. to ATEX
EC-type examination certificate	PTB 05 ATEX 2017 X

Electric Temperature Transmitter TTH200-E1H	
Fault indication	
Sensor breakage	> 22 mA
Sensor short-circuit	< 3.6 mA
Sensor wire breaking	< 3.6 mA or > 22 mA
Supply voltage with reverse poles	0 mA
Deviation from terminal-based linearity	≤ 0.1% or ≤ 0.2 K (whichever value is greater)
Influence of ambient temperature	≤ 0.08 %/10 K for lower measuring range value and measuring span, based on 20 °C
Influence of supply voltage	< 0.5 %/10 V
Output signal refreshment rate	0.4 s when the input signal changes < 0.25 K/s
Electrical isolation (I/O)	3.5 kV_{DC} (approx. 2.5 kV_{AC}), 60 s, input/output
Long-term stability	≤ 0.05 % or 0.1 K per year (whichever value is greater)
Type 6112- … i/p Transmitter Module	
Type 6112-02 without explosion protection	Input impedance 200 Ω and ~ 5.9 mH
Type 6112-22 with explosion protection [1)]	Intrinsically safe input circuit · Input impedance 200 Ω and ~ 0 mH
Explosion protection	Ex II 2 G EEx ia IIC T6
EC-type examination certificate	PTB 00 ATEX 2021
Input	4 to 20 mA or 0 to 20 mA
Output	0.2 to 1 bar or 3 to 15 psi
Supply air	1.4 bar ± 0.1 bar (20 psi ± 1.5 psi), air consumption < 0.1 m_n^3/h
Performance	Characteristic: Output linear to input
Influence	Hysteresis ≤ 0.3 % · Deviation from terminal-based linearity ≤ 0.1 % (fixed set point)
Supply air	0.1 %/0.1 bar
Ambient temperature	< 0.03 %/K for lower measuring range value and measuring span, based on 20 °C
Perm. ambient temperature range	–40 to +60 °C [1)]

1) Refer to attached EC-type examination certificates for details (on permissible temperatures, effective internal capacitance and inductance)

T R A N S L A T I O N

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 00 ATEX 2021

(4) Equipment: Model 6112-2... i/p- Module

(5) Manufacturer: SAMSON AG

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) This equipment and any acceptable variations thereof are specified in the schedule to this certificate and the documents referred to therein.

(8) The Physikalisch-Technische Bundesanstalt, certified body number 0102 according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirement relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres specified in Annex II to the Directive.

The examination and test results are recorded in confidential report

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with

EN 50014: 1997 **EN 50020: 1994**

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Test Report **PTB Ex 99-29418**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) According to the Directive 94/9/EC, this EC TYPE EXAMINATION CERTFICATE relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of the equipment.

(12) The marking of the equipment shall include the following:

Ex **II 2 G EEx ia IIC T6**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 18 February 2000

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb20-6112.doc

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 00 ATEX 2021**

(15) **Description of Equipment**

The model 6112-2... i/p Module is intended for attachment to i/p positioners, i/p pressure transmitters and i/p converter.

The device is intended for use inside and outside of hazardous areas.

The Model 6112-2... i/p Module is a passive two-terminal network which may be connected to any certified intrinsically safe circuits, provided the permissible maximum values of U_i, I_i and P_i are not exceeded.

The correlation between temperature classification, permissible maximum ambient temperature ranges and maximum short-circuit currents is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-45 °C ... 60 °C	85 mA or
T5	-45 °C ... 70 °C	100 mA or
T4	-45 °C ... 80 °C	120 mA

Electrical data

Power supply............. Type of protection. Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 100 mA or 85 mA resp.
P_i = 0,7 W

C_i = negligible, L_i = negligible

(16) **Test report** **PTB Ex 00-29418**

(17) **Special conditions for safe use**

None

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(18) **Essential Health and Safety Requirements**

In compliance with the standards specified above

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 18 February 2000

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb20-6112.doc

(1) # EC-TYPE-EXAMINATION CERTIFICATE
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 03 ATEX 2083 X

(4) Equipment: Measuring transducer, type TH 01-Ex, TH 101-Ex, TH 201-Ex and TH 201-Ex with indicator

(5) Manufacturer: ABB Automation Products GmbH

(6) Address: Borsigstraße 2, 63754 Alzenau, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-23157.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 + A1 + A2 **EN 50020:2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

Ex II 2 (1) G EEx [ia] ib IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, July 10, 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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Physikalisch-Technische Bundesanstalt PTB
Braunschweig und Berlin

(13) # S C H E D U L E

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

(15) Description of equipment

The measuring transducers of type series TH *01-Ex are used in combination with sensors for the detection, amplification and transmission of measurands in intrinsically safe circuits. Resistive thermometers, thermo-couples or other sensors with defined quantities of resistance and direct voltage may be connected alternatively to the input as measuring sensors.

The TH *01-Ex-series comprises the following types:

-TH 01-Ex sensor-head measuring transducer
-TH 101-Ex measuring transducer in rail-terminal housing, 1-and 2-channel
-TH 201-Ex measuring transducer in field housing with or without indicator

For permissible range of the ambient temperature depending on temperature class and type of measuring transducer reference is made to the table below:

temperature class		T6	T5	T4, T3, T2, T1
permissible range of the ambient temperature for type of measuring transducer	TH 201-Ex with indicator	---	---	-40 °C...+85°C
	TH 01-Ex TH 101-Ex TH 201-Ex without indicator	-40 °C...+50 °C	-40 °C...+65 °C	-40 °C...+85°C

Electrical data

Measuring transducer type TH 01-Ex and TH 201-Ex

Supply circuit ....type of protection EEx ib IIC or EEx ib IIB
(terminals „+“ and „-“) for connection to certified intrinsically circuits

maximum input values:

U_i = 29.4 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

sheet 2/6

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring circuit ....type of protection EEx ia IIC or EEx ia IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC or EEx ib IIB

with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 20 mW
linear characteristic
I_{dyn} = 145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring transducer type TH 101-Ex

Supply circuit(s) .... type of protection EEx ib IIC/IIB
(channel1: terminals 31+, 32-) for connection to certified intrinsically circuits
(channel 2: terminals 41+, 42-)

maximum input values:

U_i = 29.4 V
I_i = 130 mA
P_i = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

Measuring circuits............................... type of protection EEx ia IIC/IIB
(channel 1: terminals 11, 12, 13, 14) . or EEx ib IIC/IIB
(channel 2: terminals 21, 22, 23, 24).... with the following maximum values per circuit:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 20 mW
linear characteristic
I_{dyn} = 145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

Both channels of the measuring transducer TH 101-Ex are safely electrically isolated from each other up to a peak value of the total voltage of 60 V.

Measuring transducer TH 201-Ex with indicator

Supply circuit .... type of protection EEx ib IIC or EEx ib IIB
(terminals „+" and „-") for connection to certified intrinsically circuits

maximum input values:

U_i = 29.4 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 28 nF.
The effective internal inductance is 440 µH.

Measuring circuit .... type of protection EEx ia IIC or EEx ia IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC or EEx ib IIB
with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 20 mW
linear characteristic
I_{dyn} =145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

(16) Test report PTB Ex 03-23157

(17) Special conditions for safe use

1. The connection facilities of the measuring transducer, type TH 01-Ex shall be installed as such, that at least the degree of protection IP 20 in accordance with IEC-publication 60529:1989 is met.
2. Inadmissible electrostatic charge of the plastic housing shall be avoided. A warning label shall point to this danger.

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, July 10, 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

1. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

(Translation)

Equipment: Measuring transducer, type TH 01-Ex, TH 101-Ex, TH 201-Ex and TH 201-Ex with indicator

Marking: Ex **II 2 (1) G EEx [ia] ib IIC T6**

Manufacturer: ABB Automation Products GmbH

Address: Borsigstraße 2, 63754 Alzenau, Germany

Description of supplements and modifications

The measuring transducers of type series TH *01-Ex have been revised. The modifications concern the internal construction, a further type differentiation (HW-versions), the application as category-1 equipment for specific types of the TH 01-Ex-series provided with hardware version HW 2.xx, the marking, the "Electrical data", the permissible ranges of the ambient temperature as well as the "Special conditions".

The TH *01-Ex-series comprises the following types:

- -TH 01-Ex HW 1.xx, sensor-head measuring transducer
- -TH 01-Ex HW 2.xx, sensor-head measuring transducer
- -TH 101-Ex HW 1.xx, measuring transducer in rail-terminal housing, 1-and 2-channel
- -TH 101-Ex HW 2.xx, measuring transducer in rail-terminal housing, 1-and 2-channel
- -TH 201-Ex HW 1.xx, measuring transducer in field housing without indicator
- -TH 201-Ex HW 2.xx, measuring transducer in field housing without indicator
- -TH 201-Ex HW 1.xx, measuring transducer in field housing with indicator
- -TH 201-Ex HW 2.xx, measuring transducer in field housing with indicator

The marking for the measuring transducers of types TH 01-Ex HW 2.xx and TH 201-Ex HW 2.xx without indicator is: Ex **II 1 G EEx ia IIC T6**

The marking for the measuring transducers of types TH 201-Ex HW 2.xx with indicator is:
Ex **II 1 G EEx ia IIC T4**

For permissible range of the ambient temperature depending on temperature class and type of measuring transducer, reference is made to the table below:

temperature class		T6	T5	T4, T3, T2, T1
permissible range of the ambient temperature for measuring transducer, type ... for application as category-2 equipment	TH 201-Ex HW 1.xx with indicator TH 201-Ex HW 2.xx with indicator	---	---	-20 °C...+85 °C
	TH 01-Ex HW 1.xx TH 01-Ex HW 2.xx TH 101-Ex HW 1.xx TH 101-Ex HW 2.xx TH 201-Ex HW 1.xx w/o indicator TH 201-Ex HW 2.xx w/o indicator	-40 °C*...+50 °C	-40 °C*...+65 °C	-40 °C*...+85 °C
permissible range of the ambient temperature for measuring transducer, type ... for application as category-1 equipment	TH 201-Ex HW 2.xx with indicator	---	---	-20 °C...+60 °C
	TH 01-Ex HW 2.xx with indicator TH 201-Ex HW 2.xx w/o indicator	-20 °C...+38 °C	-20 °C...+50 °C	-20 °C...+60 °C

* optional -50 °C

Electrical data

Measuring transducer, type TH 01-Ex HW 1.xx and TH 201-Ex HW 1.xx without indicator

Supply circuit .... type of protection EEx ib IIC/IIB
(terminals „+" and „-") for connection to certified intrinsically circuits

maximum input values:

U_i = 29.6 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring circuit ....type of protection EEx ia IIC or EEx ia IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC or EEx ib IIB
with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} =145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring transducer, type TH 101-Ex HW 1.xx

Supply circuit(s) .... type of protection EEx ib IIC/IIB
(channel 1: terminals 31+, 32-) for connection to certified intrinsically circuits
(channel 2: terminals 41+, 42-)

maximum input values:

U_i = 29.6 V
I_i = 130 mA
P_i = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

Measuring circuits.. type of protection EEx ia IIC/IIB
(channel 1: terminals 11, 12, 13, 14) . or EEx ib IIC/IIB
(channel 2: terminals 21, 22, 23, 24).......... with the following maximum values per circuit:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} = 145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
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The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuits are safely electrically isolated from the respective measuring circuits up to a peak value of the total voltage of 30 V.

Both channels of the measuring transducer TH 101-Ex are safely electrically isolated from each other up to a peak value of the total voltage of 60 V.

Measuring transducer, type TH 201-Ex HW 1.xx with indicator

Supply circuit ....type of protection EEx ib IIC/IIB
(terminals „+“ and „-“) for connection to certified intrinsically circuits

maximum input values:

U_i = 29.6 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 28 nF.
The effective internal inductance is 440 µH.

Measuring circuit.......................................type of protection EEx ia IIC/IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC/IIB
with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} =145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

Measuring transducer, type TH 01-Ex HW 2.xx and TH 201-Ex HW 2.xx without indicator

Supply circuit ....type of protection EEx ia IIC/IIB
(terminals „+“ and „-“) for connection to certified intrinsically circuits

maximum input values:

U_i = 29.6 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring circuit .... type of protection EEx ia IIC/IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC/IIB

with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} = 145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Measuring transducer, type TH 101-Ex HW 2.xx

Supply circuit(s) .... type of protection EEx ia IIC/IIB
(channel 1: terminals 31+, 32-) for connection to certified intrinsically circuits
(channel 2: terminals 41+, 42-)

maximum input values:

U_i = 29.6 V
I_i = 130 mA
P_i = 0.8 W

The effective internal capacitance is 15 nF.
The effective internal inductance is 220 µH.

Measuring circuits .... type of protection EEx ia IIC/IIB
(channel 1: terminals 11, 12, 13, 14) or EEx ib IIC/IIB
(channel 2: terminals 21, 22, 23, 24

with the following maximum values per circuit

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} = 145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuits are safely electrically isolated from the respective measuring circuits up to a peak value of the total voltage of 30 V.

Both channels of the measuring transducer TH 101-Ex are safely electrically isolated from each other up to a peak value of the total voltage of 60 V.

Measuring transducer,type TH 201-Ex HW 2.xx with indicator

Supply circuit ....type of protection EEx ia IIC/IIB
(terminals „+" and „-") for connection to certified intrinsically circuits

maximum input values:

U_i = 29.6 V
I_i = 130 mA
Pi = 0.8 W

The effective internal capacitance is 28 nF.
The effective internal inductance is 440 µH.

Measuring circuit.......................................type of protection EEx ia IIC or EEx ia IIB
(terminals 1, 2, 3 and 4) or EEx ib IIC or EEx ib IIB
with the following maximum values:

U_o = 5.6 V
I_o = 1.5 mA (load current for sensor)
P_o = 3 mW
linear characteristic
I_{dyn} =145 mA (dynamic short-circuit current)

The effective internal capacitance is 50 nF.
The effective internal inductance is negligibly low.

The maximum permissible external inductance and capacitance depend on the connected intrinsically safe circuit as follows:

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

passive sensors:

type of protection	EEx ia /ib	
	IIC	IIB
L_o	1 mH	1 mH
C_o	2.3 µF	14.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

aktive sensors with the following maximum values:

U_o = 1.2 V
I_o = 50 mA
P_o = 60 mW

type of protection	EEx ia /ib	
	IIC	IIB
L_o	0.5 mH	1 mH
C_o	2 µF	10.9 µF

(the tabulated values are based on the dynamic short-circuit current I_{dyn} = 145 mA)

The supply circuit is safely electrically isolated from the measuring circuit up to a peak value of the total voltage of 30 V.

Special conditions for safe use

1. The connection facilities of the measuring transducer, type TH 01-Ex HW x.xx shall be installed as such, that the minimum degree of protection IP 20 in accordance with IEC-publication 60529:1989 is met.
2. Inadmissible electrostatic charge of the plastic housing of the measuring transducer, type TH 101-Ex HW x.xx shall be prevented. A warning label shall point to this danger.

Applied standards

EN 50014:1997 + A1 + A2 **EN 50020:2002** **EN 50284:1999**

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2083 X

Test report: PTB Ex 05-25189

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Direktor und Professor

Braunschweig, December 9, 2005

Sheet 11/11

(1) EC-TYPE-EXAMINATION CERTIFICATE
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 99 ATEX 2219 X

(4) Equipment: Slot-type initiators types SJ... and SC...

(5) Manufacturer: Pepperl + Fuchs GmbH

(6) Address: D-68307 Mannheim

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 99-29175.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 **EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:

Ex II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, December 22, 1999

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24

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(13) SCHEDULE

(14) EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2219 X

(15) Description of equipment

The slot-type initiators of types SJ... and SC... are used to convert displacements into electrical signals.

The slot-type initiators may be operated with intrinsically safe circuits certified for categories and explosion groups [EEx ia] IIC or IIB resp. [EEx ib] IIC or IIB. The category as well as the explosion group of the intrinsically safe slot-type initiators depends on the connected supplying intrinsically safe circuit.

Electrical data

Evaluation and supply circuit............................type of protection Intrinsic Safety EEx ia IIC/IIB
.... resp. EEx ib IIC/IIB
only for connection to certified intrinsically safe circuits
Maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of slot-type intiators are shown in the table:

sheet 2/3

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2219 X

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
SC2-N0...	150	150	72	87	100	65	80	100	40	55	75	23	38	54
SC3,5-N0-Y...	150	150	72	87	100	65	80	100	40	55	75	23	38	54
SC3,5...-N0...	150	150	73	88	100	66	81	100	45	60	89	30	45	74
SJ1,8-N-Y...	30	100	73	88	100	67	82	100	45	60	78	30	45	57
SJ2,2-N...	30	100	73	88	100	67	82	100	45	60	78	30	45	57
SJ2-N...	30	100	73	88	100	67	82	100	45	60	78	30	45	57
SJ3,5-...-N...	50	250	73	88	100	66	81	100	45	60	89	30	45	74
SJ3,5-H...	50	250	73	88	100	66	81	100	45	60	89	30	45	74
SJ5-...-N...	50	250	73	88	100	66	81	100	45	60	89	30	45	74
SJ5-K...	50	550	72	87	100	66	81	100	42	57	82	26	41	63
SJ10-N...	50	1000	72	87	100	66	81	100	42	57	82	26	41	63
SJ15-N...	150	1200	72	87	100	66	81	100	42	57	82	26	41	63
SJ30-N...	150	1250	72	87	100	66	81	100	42	57	82	26	41	63

(16) Test report PTB Ex 99-29175

(17) Special conditions for safe use

1. For the application within a temperature range of -60°C to -20 °C the slot-type initiators of types SJ... and SC... must be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the slot-type initiators of types SJ... and SC... shall be installed as such that at least a degree of protection of IP20 according to IEC-publication 60529:1989 is met.
3. The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of slot-type initiators is shown in the table given under item (15) of this EC-type-examination certificate..
4. Inadmissible electrostatic charge of the plastic housing of the slot-type initiators of type SJ30-N..., has to be avoided (warning label on the device).

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, August 10, 1999

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2219 X

(Translation)

Equipment: Slot-type initiators, types SJ... and SC...

Marking: Ⓔx **II 2 G EEx ia IIC T6**

Manufacturer: Pepperl + Fuchs GmbH

Address: Königsberger Allee 87, 68307 Mannheim, Germany

Description of supplements and modifications

The slot-type initiators of type series SJ... and SC... listed below may in future also be used in hazardous areas where equipment of catagory-1 is required.

The modifications exclusively concern the „Electrical data" (change of maximum permissible ambient temperatures for application as category-1 equipment, reduction of the intrinsically safe evaluation and supply circuit to category ia) as well as the marking of the slot-type initiators listed below.

SC2-N0...	SJ5-...-N...
SC3,5-N0-Y...	SJ5-K...
SC3,5...-N0...	SJ10-N...
SJ2-N...	SJ15-N...
SJ3,5-...-N...	SJ30-N...

For application as category-1 equipment the marking of the slot-type initiators listed above will be in the future:

Ⓔx **II 1 G EEx ia IIC T6**

The „Special conditions" are also valid for application as category-1 equipment without changes.

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2219 X

Electrical data

Evaluation and supply circuit — type of protection Intrinsic Safety EEx ia IIC/IIB only for connection to certified intrinsically safe circuits
Maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of slot-type intiators are shown in the following table:

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
SC2-N0...	150	150	55	67	95	48	60	88	23	35	63	6	18	46
SC3,5-N0-Y...	150	150	55	67	95	48	60	88	23	35	63	6	18	46
SC3,5...-N0...	150	150	56	68	96	49	61	89	28	40	68	13	25	53
SJ2-N...	30	100	56	68	96	49	61	89	28	40	68	13	25	53
SJ3,5-...-N...	50	250	56	68	96	49	61	89	28	40	68	13	25	53
SJ5-...-N...	50	250	56	68	96	49	61	89	28	40	68	13	25	53
SJ5-K...	50	550	55	67	95	48	60	88	25	37	65	9	21	49
SJ10-N...	50	1000	55	67	95	48	60	88	25	37	65	9	21	49
SJ15-N...	150	1200	55	67	95	48	60	88	25	37	65	9	21	49
SJ30-N...	150	1250	55	67	95	48	60	88	25	37	65	9	21	49

Test report: PTB Ex 03-23133

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, October 29, 2003

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 00 ATEX 2049 X

(4) Equipment: SN-sensors, types NJ... and SJ...

(5) Manufacturer: Pepperl + Fuchs GmbH

(6) Address: D-68307 Mannheim

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 00-29268.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 **EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:

Ex II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, October 05, 2000

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(13) # S C H E D U L E

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2049 X

(15) Description of equipment

The SN-sensors, types NJ... and SJ... are used to convert displacements into electrical signals.

The SN-sensors, types NJ... and SJ... may be operated with intrinsically safe circuits certified for categories and explosion groups [EEx ia] IIC or IIB resp. [EEx ib] IIC or IIB. The category as well as the explosion group of the SN-sensors depends on the connected supplying intrinsically safe circuit.

Electrical data

Evaluation and
supply circuit............................type of protection Intrinsic Safety EEx ia IIC/IIB
resp. EEx ib IIC/IIB
only for connection to certified intrinsically safe circuits
maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of SN-sensors is shown in the following table:

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NJ 2-11-SN...	50	150	73	88	100	66	81	100	45	60	89	30	45	74
NJ 2-11-SN-G...	50	150	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-12GK-SN...	50	150	73	88	100	69	84	100	51	66	80	39	54	61
NJ 3-18GK-S1N...	70	200	73	88	100	69	84	100	51	66	80	39	54	61
NJ 4-12GK-SN...	70	150	73	88	100	69	84	100	51	66	80	39	54	61
NJ 5-18GK-SN...	120	200	73	88	100	69	84	100	51	66	80	39	54	61
NJ 5-30GK-S1N...	100	200	73	88	100	69	84	100	51	66	80	39	54	61
NJ 6-22-SN...	110	150	73	88	100	69	84	100	51	66	80	39	54	61
NJ 6-22-SN-G...	110	150	76	91	100	73	88	100	62	77	81	54	63	63
NJ 6S1+U.+N...	180	150	73	88	100	69	84	100	51	66	80	39	54	61
NJ 8-18GK-SN...	120	200	73	88	100	69	84	100	51	66	80	39	54	61
NJ 10-30GK-SN...	120	150	73	88	100	69	84	100	51	66	80	39	54	61
NJ 15-30GK-SN...	120	180	73	88	100	69	84	100	51	66	80	39	54	61
NJ 15S-U.-N...	180	150	73	88	100	66	81	100	45	60	89	30	45	74
NJ 20S-U.-N...	200	150	73	88	100	66	81	100	45	60	89	30	45	74
NJ 40-FP-SN...	370	300	73	88	100	66	81	100	45	60	89	30	45	74
SJ 2-SN...	30	100	73	88	100	66	81	100	45	60	78	30	45	57
SJ 2-S1N...	30	100	73	88	100	66	81	100	45	60	78	30	45	57
SJ 3,5-S1N...	30	100	73	88	100	66	81	100	45	60	89	30	45	74
SJ 3,5-SN...	30	100	73	88	100	66	81	100	45	60	89	30	45	74

(16) Test report PTB Ex 00-29268

(17) Special conditions for safe use

1. For the application within a temperature range of -60 °C to -20 °C the SN-sensors, types NJ... and SJ... must be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the SN-sensors, types NJ... and SJ... shall be installed as such that at least a degree of protection of IP20 according to IEC-publication 60529:1989 is met.
3. The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of SN-sensors is shown in the table given under item (15) of this EC-type-examination certifcate.

Physikalisch-Technische Bundesanstalt

PTB

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2049 X

4. With the application in group IIC inadmissible electrostatic charge of the plastic housing has to be avoided for following types of SN-sensors (warning label on the device).:

   NJ 40-FP-SN...

5. Inadmissible electrostatic charge of parts of the metal houising has to be avoided for the following types of SN-sensors. Dangerous electrostatic charges of parts of the metal housing can be avoided by grounding of these parts whereas very small parts of the metal housing (e.g. screws) don't need to be grounded:

   NJ 2-11-SN-G...
   NJ 6-22-SN-G...
   NJ 6S1+U3+N...
   NJ 6S1+U4+N...
   NJ 15S+U3+N...
   NJ 15S+U4+N...
   NJ 20S+U3+N...
   NJ 20S+U4+N...
   NJ 40-FP-SN-P3...
   NJ 40-FP-SN-P4...

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, October 05, 2000

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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Physikalisch-Technische Bundesanstalt

PTB

Braunschweig und Berlin

1. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2049 X

(Translation)

Equipment: SN-sensors, types NJ... and SJ...

Marking: ⟨Ex⟩ II 2 G EEx ia IIC T6

Manufacturer: Pepperl + Fuchs GmbH

Address: Königsberger Allee 87, 68307 Mannheim, Germany

Description of supplements and modifications

The SN-sensors of type series NJ... and SJ... listed below may in future also be used in hazardous areas where equipment of catagory-1 is required.

The modifications exclusively concern the „Electrical data" (change of maximum permissible ambient temperatures for application as category-1 equipment, reduction of the intrinsically safe evaluation and supply circuit to category ia) as well as the marking of the SN-sensors listed below.

NJ 2-11-SN...	NJ 5-30GK-S1N..	NJ 15-30GK-SN...
NJ 2-11-SN-G...	NJ 6-22-SN...	NJ 15S-U.-N...
NJ 2-12GK-SN...	NJ 6-22-SN-G...	NJ 20S-U.-N...
NJ 3-18GK-S1N...	NJ 6S1+U.+N...	SJ 2-SN...
NJ 4-12GK-SN...	NJ 8-18GK-SN...	SJ 2-S1N...
NJ 5-18GK-SN...	NJ 10-30GK-SN...	SJ 3,5-S1N...
		SJ 3,5-SN...

For application as category-1 equipment the marking of the slot-type initiators listed above will be in the future:

⟨Ex⟩ II 1 G EEx ia IIC T6

The „Special conditions" are also valid for application as category-1 equipment without changes.

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2049 X

Electrical data

Evaluation and supply circuit — type of protection Intrinsic Safety EEx ia IIC/IIB only for connection to certified intrinsically safe circuits Maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of slot-type intiators are shown in the following table:

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NJ 2-11-SN...	50	150	56	68	96	49	61	89	28	40	68	13	25	53
NJ 2-11-SN-G...	50	150	59	71	99	56	68	96	45	57	81	37	49	63
NJ 2-12GK-SN...	50	150	57	69	97	52	64	92	34	46	74	22	34	61
NJ 3-18GK-S1N...	70	200	57	69	97	52	64	92	34	46	74	22	34	61
NJ 4-12GK-SN...	70	150	57	69	97	52	64	92	34	46	74	22	34	61
NJ 5-18GK-SN...	120	200	57	69	97	52	64	92	34	46	74	22	34	61
NJ 5-30GK-S1N...	100	200	57	69	97	52	64	92	34	46	74	22	34	61
NJ 6-22-SN...	110	150	57	69	97	52	64	92	34	46	74	22	34	61
NJ 6-22-SN-G...	110	150	59	71	99	56	68	96	45	57	81	37	49	63
NJ 6S1+U.+N...	180	150	57	69	97	52	64	92	34	46	74	22	34	61
NJ 8-18GK-SN...	120	200	57	69	97	52	64	92	34	46	74	22	34	61
NJ 10-30GK-SN...	120	150	57	69	97	52	64	92	34	46	74	22	34	61
NJ 15-30GK-SN...	120	180	57	69	97	52	64	92	34	46	74	22	34	61
NJ 15S-U.-N...	180	150	56	68	96	49	61	89	28	40	68	13	25	53
NJ 20S-U.-N...	200	150	56	68	96	49	61	89	28	40	68	13	25	53
SJ 2-SN...	30	100	56	68	96	49	61	89	28	40	68	13	25	53
SJ 2-S1N...	30	100	56	68	96	49	61	89	28	40	68	13	25	53
SJ 3,5-S1N...	30	100	56	68	96	49	61	89	28	40	68	13	25	53
SJ 3,5-SN...	30	100	56	68	96	49	61	89	28	40	68	13	25	53

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2049 X

Test report: PTB Ex 03-23134

Zertifizierungsstelle Explosionsschutz
By order

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, October 29, 2003

Sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38116 Braunschweig, Germany

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de

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